

Draft July 17, 2001

**U.S. Environmental Protection Agency
Science Advisory Board
Committee: Advisory Council on Clean Air Compliance Analysis (Council)
Panel to Review the Draft Analytical Plan for EPA's Second Prospective Analysis
Public Meeting**

Summary Minutes of Public Meeting

Date: July 9-10, 2001

Committee Members: (See Roster - Attachment A.)

Date and Time: 9 am to 5:00 pm on July 9; 8:30am to 12:00 am, July 10, 2001 (See Federal Register Notice - Attachment B).

Location: Ariel Rios North, Conference Room 6013

Purpose: The purpose of the meeting is to review the major goals, objectives, methodologies, and analytical choices for the third 812 Study before it is implemented. and provide advice prior to implementation of those methodologies.

Attendees: Chair: Dr. Trudy Cameron; COUNCIL Members: Ms. Laurie Chestnut (second day), Drs. Maureen Cropper, Don Fullerton, Lawrence H. Goulder (by phone), James Hammitt, Charles Kolstad, Lester Lave, Paul Lioy, Paulette Middleton, Dr. Kerry Smith; SAB Consultants: Drs. Panos Georgopoulos, Michael Kleinman, Tim Larson, Joseph Meyer (by telephone) and George Taylor. SAB Staff: Dr. Angela Nugent, Designated Federal Official, and Ms. Rhonda Fortson. Other Persons on the Agenda: Mr. Robert Brenner and Mr. James DeMocker (EPA, Office of Air and Radiation).

Meeting Summary:

The discussion generally followed the issues and general timing as presented in the meeting Agenda (see Meeting Agenda - Attachment C). The only changes were to move the discussion of "Data Disaggregation for Costs and Reporting Cost Results and their Uncertainties" to July 9, 2001, and the discussion of "Economic Valuation of Ecological Effects" to July 10, 2001. The teleconference lasted until 4:30 pm on July 9, 2001.

There were no written comments submitted to the Committee, and there was no written request to present public comments during the discussion. Members of the Council had prepared pre-meeting comments, which had been organized into the format of a report and had been sent by email to members and distributed to the public at the meeting. Speakers agreed to emphasize key points in their written material and points supplementary to their written material in their oral discussion.

Welcome and Introductions - Dr. Trudy Cameron, the Chair, opened the session at 1 a.m. welcoming members and consultants (Roster, Attachment A), and reviewed the agenda (Attachment C). Dr. Angela Nugent, Designated Federal Official (DFO) took roll. Dr.

Cameron requested panel members to review the minutes from the teleconferences held on June 22 2001, June 25, 2001, and July 2, 2001 and to send any comments to the DFO.

Public Disclosure

The DFO informed listeners that the SAB has determined that this panel has no legal "conflicts of interest" with the issue being reviewed. She then announced that most panel members had provided written statements to introduce themselves and describe how their background, experience and interests relate to the review of the 812 Analytical Blueprint. These "Public Disclosure" statements were made available to the public (Attachment E)

Four panel members whose written statements were not included provided oral statements. Dr. Kerry Smith stated that he was an environmental economist at North Carolina State University and past co-chair of the EPA's Environmental Economics Advisory Committee with Allen Kneese. He has worked thirty years in the area of non-market valuation. He has public comments on the Retrospective Study regarding how we might judge the plausibility of its results.

Dr. George Taylor introduced himself as a professor at George Mason University with a specialty in plant physiology, and a particular interest in interactions between plants and atmospheric conditions (e.g., ozone, acid rain and nitrogen). He has made no public pronouncements that would interfere with his involvement in the review.

Dr. Charles Kolstad stated that he was a professor of economics at the University of California, Santa Barbara. He has conducted research in climate change and the nature of regulation in that area.

Dr. Don Fullerton stated that he was professor of economics at the University of Texas, where he has worked in the area of solid waste and auto emissions. He was particularly interested in regulatory strategies and the study of tax interactions effects.

Agency Goals for the Analysis

Mr. Robert Brenner, Acting Assistant Administrator for the Office of Air and Radiation, discussed the value of the 812 Study to his office and more broadly for policy-making in the federal government. He assured the panel members that the Agency and interested members of the public were aware that the Clean Air Act imposed \$20 billion in compliance costs, and the need to understand clearly and communicate clearly the benefits associated with air programs.

He mentioned that the Agency had used information from the previous 812 Analysis in its diesel retrofit efforts and has used the analysis to identify cross-title strategies for addressing significant pollutants. The Agency and others in the Administration have used the 812 Analysis in developing the three-pollutant bill (addressing nitrous oxides, sulfur oxides, and mercury) focusing on utilities. He reported that policy analysts working on the bill consider the 812 Analysis to provide reliable benefit-cost information.

He described goals for the present study: to disaggregate benefit-cost information in a meaningful way; to refine and extend the methodologies used, and to extend the Agency's analysis of uncertainty.

Mr. Brenner then took questions from the panel. He confirmed that the Agency intended

to use the results of disaggregation to identify synergies across titles, where parts of the air program could be used more effectively together. He stated that the 812 methodology had been used to strengthen Regulatory Impact Analyses (RIAs) for recent regulations, and that detailed information on those regulations would be available to support a breakdowns by regulation. He stated that his office was frustrated by the inability to provide quantitative or monetized benefits for ecological services. He requested the Council's assistance in constructing a Second Prospective Analysis that would convey those benefits more clearly and also convey the significance of the uncertainties associated with not including quantification of those benefits in the "bottom line."

Overall Analytical Approach

Dr. Maureen Cropper led the discussion by directing the panelists to her written comments on the Agency's Analytical Plan. She stated that disaggregation of benefits and costs by title was less useful than breakdowns by sector, focusing on regulations. She stated that the RIAs described by Mr. Brenner could be used in such an analysis.

She stated that the jointness in costs across titles would make disaggregation by title difficult, if not impossible. She also discussed the analytical problems of: (1) linking changes in emissions to changes in ambient concentrations; (2) linking changes in emissions to changes in titles; and (3) deciding on an appropriate baseline.

Dr. Paul Liroy, Chair of the Health and Ecological Effects Subcommittee, called for using the Second Prospective Analysis as an *ex post* validation of key assumptions made and models used in the First Prospective analysis. He pointed out the value of using monitoring data.

Dr. Kerry Smith agreed and described the 812 process as a learning laboratory, where there could be a systematic effort to understand and validate the key elements of models.

Scenario Development

Dr. Smith began the discussion by focusing on the Agency's first key specific question, "Should EPA model alternative baseline scenarios to address uncertainties about the ultimate scope and implications of the President's energy plan?" He pointed out the large set of factors likely to be impacted by energy policy. He suggested that the Agency identify how energy prices influence the Prospective Analysis and plan for a sensitivity analysis.

He then turned his attention to the use of scenarios to check and improve the data and methods used in the 812 analytical process. He suggested that checking model results against monitoring results, and testing differing model approaches against each other would reconcile outcomes of competing studies. He suggested the Agency identify observable variables that are required intermediates for deriving benefit measures. He suggested the following examples: (1) comparing mortality statistics by demographic groups against the forecast of lives saved; (2) recreation days projected against actual days available; and (3) census information about growth vs. assumed growth in models.

Dr. Cropper suggested adding measurements of direct compliance costs and non-trauma deaths.

Dr. Kolstad suggested using the Department of Energy's forecasts about fuel consumption and its data, as well as other agencies' forecasts and evaluations.

Dr. Fullerton warned that observable costs will likely reflect direct and not indirect costs. Panel members discussed the availability of surveys of direct costs, and its usefulness for characterizing cost uncertainty. There are econometric studies, e.g., by Morgenstern-Pizer, that provide a long established data base with information about sectoral costs. Panel members questioned whether the new PACE survey will be available; the Agency confirmed that results will not be available for the Second Prospective Study.

Estimating Emissions and Modeling Air Quality

Dr. Paulette Middleton, Chair of the Air Quality Modeling Subcommittee (AQMS), called the relationship of emissions and concentrations a critical link, especially for ozone and particulate matter. She supported disaggregation by sector, regulation, and geography rather than by title. She stated that the AQMS is opposed to very long-term forecasts and pointed the Council to the several detailed questions raised by the AQMS, including how biogenic emissions affect the Agency's interest in moving to Mobile 6.1. She emphasized the importance of the agency considering the sensitivities of assumptions made in its baseline for emissions.

Dr. Panos Georgopolous, member of the AQMS, called for more detail from the Agency on its modeling plan, including a statement of Data Quality Objectives. He questioned whether the version of REMSAD, promised for Fall 2001, would be the appropriate platform for PM 2.5 and whether it could produce ozone dynamics. He wondered whether the levels of precision and accuracy would be acceptable, even in the face of the time and money constraints.

Dr. Middleton confirmed that it was especially difficult to model ozone and fine particulates.

Dr. Smith asked whether the Agency might consider simpler models that might provide reasonably accurate results, useful in terms of the benefit-cost analysis needed. Drs. Cropper and Middleton replied that the Agency's current methodology involves generation of daily and hourly exposures for 8 km segments, to generate PM exposures used in mortality calculations and ozone exposures used in morbidity calculations.

Health and Ecological Effects

Dr. Paul Liroy began by reporting that the HEES had provided detailed response in written form to the Analytical Plan. He pointed panel members to those comments and mentioned that methodology for health assessment was changing. PM and ozone were used as a surrogate for air-pollution-related health effects. He mentioned the emerging importance of secondary aerosols. He asked HEES members present to comment on the high-priority topics they had discussed in the subcommittee.

Dr. Michael Kleinman discussed the HEES recommendations to improve the Agency's discussion of air toxics. He recommended that the Agency conduct a benefits assessment for benzene, as one of the best-characterized air toxics. He suggested the Agency use available hazard and exposure data and characterize the uncertainties fully. Such an analysis would provide an upper bound on the benefits associated with benzene. It would lead to some progress in understanding the potential hazards associated with Hazardous Air Pollution and spur research.

Dr. George Taylor criticized the Analytical Plan for focusing the analysis on "natural

resource values, which provide 10% or less of total benefits from systems” and not for capturing ecosystem services in the main analysis. Relegating the discussion of ecosystem services to a narrative in an Appendix was not appropriate.

He mentioned, as a possible bounding number for ecosystem services, the research of Drs. Costanza, Daly and others. Dr. Joseph Meyer, another member of the HEES, pointed out that there doesn’t exist a good algorithm to monetize ecological effects; there is no analogy to the disease-by-disease strategy used by economists to characterize health effects.

Council members briefly discussed analytical issues associated with Dr. Costanza’s article.

Dr. Lester Lave pointed out that the stalemate on this topic might best be solved by research. Members of the panel acknowledged that the approach proposed by the Analytical Plan essentially characterizes ecosystem effects as “zero” and discussed the need to provide a more useful assessment. The panel discussed setting up a working group to help the Agency with this part of the analysis.

Economic Valuation of Health Effects

Drs. Larry Goulder and Jim Hammitt led the discussion on this topic. They introduced the comprehensive review of Value of Statistical Life (VSL) studies planned by EPA and the selection criteria proposed. They referred panel members to their detailed written comments. Dr. Hammitt suggested that the Agency conduct a meta-analysis that screened out certain studies and that took advantage of information provided by others. The meta-analysis would give partial weights to the VSL/risk reduction ratio and other factors. The panel discussed how to weight by age and discounting.

The panel then discussed alternatives to VSLs. One alternative discussed was QALYs, which do not meet the Kaldor Hicks criterion. The group pointed out that EPA’s mandate is benefit-cost purely. Alternative social welfare cost functions would aggregate benefit-costs beyond Kaldor-Hicks. Several members stated that use of QALYs had an intuitive appeal and were appropriate to include in the Second Prospective Analysis as a side-analysis.

Uncertainty Analysis

Mr. James DeMocker provided an overview of the major issues in the chapter devoted to Uncertainty Analysis in the Analytical Plan.

Drs. Middleton and Liroy began the discussion by commenting that the model needs to make a significant change to make the uncertainty analysis worthwhile. They suggested that the Agency conduct sensitivity tests for six of the most costly provisions. The tests would examine the distributions on key factors underpinning the cost equations. They might consider growth rate assumptions, emissions, forecasts, meteorological data, biogenic inventories, boundary conditions, and modeled chemistry.

Dr. Lave, the lead discussant, began by emphasizing the appropriateness of disaggregating by program, not geography. In regard to uncertainty analysis, he stated that characterizing uncertainty more clearly than “low/medium/high” will “get the Agency into trouble,” but that the intellectual honesty will be a huge step forward and identify what is needed to reduce the uncertainty bounds.

He mentioned areas of significant uncertainties. Much cost information is not known. Does EPA know the true costs of technology forcing regulations, such as tailpipe emissions? He also listed uncertainties related to benefits. The Agency assumes dose-response relationships are proportional, but they may not be. Agency does not have information regarding thresholds and where to use them. The Agency lacks information on susceptible populations.

He emphasized the importance of establishing comprehensive error bars and not simply relying on standard errors. For hazardous air pollutants, the Agency should show the posterior distribution of variable used. Zero can be included. Including such uncertainty analysis is likely to be a lightening rod, but ignoring uncertainty is unacceptable. It will be necessary to develop an analysis and describe it in plain language that lay people can understand.

Other panel members supported this view. They mentioned that emissions do have distributions; that model uncertainties will need to be characterized, as well as statistical uncertainties; and that errors in measurement will need to be distinguished from unknowns.

Aggregation and Reporting

Mr. DeMocker introduced the discussion with a quick overview of the major issues associated with results aggregation and reporting, as described in the Analytical Plan.

Drs. Cameron and Kerry Smith were the lead discussants. They addressed Key Specific Question 5 and agreed that geographic disaggregation of benefits and costs was too difficult to do, although it may be possible to disaggregate benefits.

Dr. Smith stated that the Agency cannot convincingly disaggregate costs, which overall regions, however defined. Both discussants advised EPA to “hold the line” against geographic disaggregation.

Other panel members joined the discussion. Dr. Cropper agreed that the regional incidence of complicated general equilibrium cost effects were not known. From a physical and economic perspective, financial costs were widely distributed; stockholders and consumers live elsewhere than any geographic region defined.

Dr. Lioy emphasized the importance of regional disaggregation, calling it “absolutely imperative.” In his experience, he has seen state legislatures asking for justification for inspection-maintenance programs, and there is no way to provide this information. He suggested that well-defined regions for controlling Particulate Matter and ozone exist, that could provide information for regional net benefits. Regional disaggregation could be done also by sector within these control regions.

Dr. Cropper responded by suggesting that benefits, especially for Titles 1-4, could be calculated, but not costs. Dr. Middleton suggested that the Agency sort through the cost categories and clarify for the public why disaggregation for particular cost categories should not be done. Dr. Kleinman followed with the comment that plant managers “think costs come out of their pockets,” not the pockets of the corporation generally, or stockholders or consumers.

Cost Modeling and Cost Evaluation Tools (including Stratospheric Ozone Cost Analysis)

Dr. Don Fullerton led the discussion. His first comments referred to the lack of information about many of the cost models listed in the Analytical Plan. He wondered whether and how certain categories of costs were included: process changes; technology changes; and

inefficiencies in meeting standards. Dr. Cropper referred to a related article in *JPE* 2000 addressing cost of sulphur dioxide reductions.

Dr. Smith commented that there are multiple sources of uncertainty in cost estimates and the Agency might pursue econometric estimates of costs. It would also be useful to validate information about costs with information from emission tracing programs. Dr. Lave commented that these prices might fluctuate widely. Dr. Kolstad stated that it may be difficult to get more precise about costs. The RECLAIM program is dynamic; it is difficult to back out costs. Dr. Smith responded that the agency should keep in mind the goals to validate components for all models, including cost models

Dr. Lioy suggested focusing on the sectors of most interest, for example, power plants..

Estimating Economic and Social Costs (Including Computable General Equilibrium Modeling (CGE), Tax Interaction Effects)

Dr. Fullerton began the discussion with a review of the utility of the CGE model and the differences between direct costs and social costs. In a market without monopoly or tax distortions, direct costs are close to the social cost because the dead weight loss is small. Where there are these distortions, the social cost can be significantly greater.

Reasons for using the CGE model include: (1) differences between social and direct costs; (2) to capture feedback effects on emissions--industries expand/contract with regulatory changes and the emissions patterns change; (3) to capture productivity-linked benefits; and (4) to predict sectoral effects, regional effects, employment, investment, and many other outcomes of policy. He recommended that the Agency articulate these or other reasons for using the CGE model as criteria for selecting a model

He stated that the Jorgenson/Ho/Wilcoxon model could provide all four benefits, but will not be available for the Second Prospective Study. Other models have different issues. The Rutherford model will not provide productivity-linked health benefits. Regional models do not have the resolution or the ability to capture national-scale costs. He suggested a rigorous screening of available models before the Agency selects a model to use.

The panel then discussed ways to add the tax-interaction effect by regulation and sector. The generally agreed that the Agency should model each regulation within the given sector, and not apply a general factor.

The panel expressed the view that there was no doubt about the existence of tax interaction effect, and that the Analytical Plan should not indicate doubt. The issue concerned measurement of the effect. Dr. Smith commented that it is difficult to determine a single number for constant to be applied to all regulations. The group discussed how to account for feedback effects caused by changes in relative prices and the associated change on demand composition. There is also a feedback effect of changes in benefits relating to morbidity on productivity. These effects are not separable.

Dr. Cropper stated that she supported Dr. Fullerton. Most health benefits accrue to people over 65 years of age and not to prime age people in the workforce. Changes in demand composition would need to be empirically estimated.

Dr. Larry Goulder confirmed that he agreed with Dr. Fullerton. EPA's last prospective study disappointed him in its failure to emphasize tax interaction effects. It is certain they are not zero and the central tendency is pretty clear. He agreed that there is no single constant ex

post, and the factor depends on the type of regulation. For command and control programs, the factor is 1.3 or probably more; for grandfathered permits, 2 would be a conservative factor. He proposed that the Agency assume separability, rather than substitution or complementary with environment and leisure. There is enough information about tax interaction effects to take them seriously. He did not recommend applying a CGE model to every regulation, but instead suggested applying appropriate factors identified in relevant studies.

Dr. Kolstad stated that the magnitude of the tax interaction effect depends on both the pollutant and industry. He saw an interplay between air pollution and the labor side.

Dr. Kleinman linked the discussion of the tax interaction effect with the cost of children's health effects and costs to their parents.

Dr. Smith restated his position: he was not questioning the tax interaction effect but the current ability to measure it on a regulation-by-regulation basis. Pre-existing distributions have an impact. If the Agency is assuming non-separabilities in benefits, it cannot assume mutuality in cost calculators. He also pointed out the large consequence of income effects on willingness to pay that change demands for goods. This effect might add to the tax interaction effect or offset it.

Dr. Fullerton responded that Dr. Smith identified important refinements. Current capabilities capture the tax interaction effect. He suggests that the Agency and Council "live with the non-separability assumptions for now."

Economic Valuation of Ecological Effects

Dr. Chestnut began her discussion by defining the benefits under discussion: all benefits not identified explicitly as human health. The current challenge is to move the discussion of the conceptual literature on ecosystem services to EPA's main analysis. Currently, the ecological literature defines service flows and characterizes them (e.g., water purification). The Appendix in EPA's First Prospective Analysis described the process by which pollution affects the natural environment. The process is partially quantifiable, but not ready to be integrated with information on emissions, deposition, effects. She recommended continuing to bring the economic valuation together with service flows. She suggested that mapping techniques are available that are effective in communicating impacts. She called for a language to communicate what cannot be quantified.

She also commented that the same ecological processes affect market and non-market values and that it would be inappropriate to view them as separate consequences.

Dr. Taylor responded from an ecological perspectives. He expressed concern about not moving towards capturing 95% of ecological benefits. He also worried about the decline in research funds to study ecosystem effects, based on the 812 analyses.

Dr. Cropper endorsed the approach of quantifying all physical effects possible. She stated that it was more useful to provide information such as a "20% decline in tree canopy as a result of pollution" rather than qualitative possibilities.

Dr. Lave expressed frustration at treatment of ecological benefits in the past. Toxicologist's ability to identify and measure subtle human physiological effects have created a bias in favor of health effects. Rather than marginal changes in approach, he advocated prominent discussion in the Analytical Plan of information deficiencies regarding ecosystem effects. The public doesn't know why they should value ecosystems and conventional economic

measures can't really value what they mean to human beings. He called for new approaches to generate fresh ideas.

Dr. Meyer stated that he appreciated this insight and the need for a new approach. He saw the need to assist the project team. The damage function approach was not yet in sight for ecological valuation and may not be right. He called for research need.

Dr. Smith stated that he agreed with Dr. Taylor--ecosystem valuation doesn't get a place at a table. In his view, damage-functions lead to endpoints that can be valued. One approach is Bockstael's analysis of the Pautuxent. Another effort is underway for the Everglades; Dr. Smith asks how difficult would it be to investigate air quality effects. Yet another effort involves secondary NAAQS. He wondered if the "Mathtech proposal," a handheld model evaluating links between air pollution and non-health related endpoints could be applied. There is also a large literature on hedonic property values (e.g., open space, trees, landscape and housing values) that could be applied to air pollution. Finally, there have been at least two or three efforts to convene ecologists and economists to define a research agenda (e.g., RESOLVE effort funded by EPA; Chesapeake, EPA water quality effort; EPA "Tampa Bay" Workshop, May 23-24, 2001).

Dr. Lioy saw the need to articulate quantitative estimates, not just new research. He suggested convening group to focus on the issue of generating a number and error bounds.

Dr. Georgopoulos raised the complication of multi-media effects. The analysis will need to distinguish between water quality impacts and air quality impacts and make those links clear.

Dr. Fullerton suggested that this problem is another example of hard to measure effects, where the best estimate is not zero, where impacts needed to be characterized in numerical form.

Dr. Chestnut responded that any number generated must be based on credible research. Dr. Smith stated that one could pick from the best available information, for example on estuary protection benefits, and adapt a number. One would need to be very candid about uncertainties and conduct an off-line evaluation. Such a number will not satisfy the benefits of the "bigger picture" but it would be a start.

Dr. Cropper advocated systematically collecting "really good estimates of damage functions."

Dr. Lioy suggested a subcommittee (3-4 economists and ecologists) to grapple with the issue.

Identification of Key Points for Advisory Letter

The panel agreed on the following major points to be adapted into the cover letter for the report:

1. Disaggregation – Endorsement of sectoral analysis (e.g., 6 sectors), rather than a title-by-title approach. Difficulty of disaggregating geographically
2. Commendation regarding uncertainty analyses re benefits and costs, especially incorporation of social costs. Identification of preferred approaches to scenarios and how uncertainty analyses relate.
3. Methodological laboratory - Council proposing refinements in areas that currently don't meet standards for analysis – components of CGE, Geographical analysis,

- air toxics, ecological assessments
4. Continue interplay between practice and ongoing research - foster feedback between monitoring and past and present modeling activities that can improve the 812 process.

Other important items identified:

1. Need to clearly identify the purpose of the study and the relevant policy questions. The Council then can identify what kinds of benefit-cost questions are really useful
2. Case study for air toxics
3. Range-finding study for ecological effects
4. Highlight to a new administration why this report will be different from previous reports
5. Greater attention to non-market benefits - push these into bottom line conclusions
6. Need for research to close key gaps in knowledge
7. Need for Agency to clarify time-line for activities involved in the Analysis
- 8.. Significance of this study; it's one of a kind
9. Disaggregation a key to relevant choices people might make. Provide summary table identifying major impact categories. Benefit /cost - qualitative estimates or ranges; HAPs; Ecosystems (few or no quantitation possible); make table comprehensive.
10. Acknowledge social costs to be different from direct cost; methods being developed to capture them.

Action items:

1. Panel members to review the minutes from the teleconferences held on June 22 2001, June 25, 2001, and July 2, 2001 and to send any comments to the DFO by July 20.
2. Panel members to revise their writing assignments and send to the DFO by July 13, 2001
3. Chair and the DFO to send a draft of the Council's Advisory on July 20, 2001 to panel members for their review and comment by July 26, 2001.

At 12:00 p.m. on July 10, 2001, Dr. Cameron adjourned the meeting.

Respectfully Submitted:

Designated Federal Official

Certified as True:

Chair

NOTE AND DISCLAIMER: The minutes of this public meeting reflect diverse ideas and suggestions offered by the Council members and consultants (M/C) to the Agency during the course of deliberations within the meeting. Such ideas, suggestions and deliberations do not necessarily reflect definitive consensus advice from the Council M/C. The reader is cautioned to not rely on the minutes to represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters, or reports prepared and transmitted to the EPA Administrator following the public meetings.